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Official Science on Saturday
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Student Notes

Science on Saturday

February 4, 2011

The Gamma-Ray Spectrometer at Mercury: A Seven-Year Journey to the Innermost Planet

Presenters:
Dr. Morgan Burks – Scientist – Lawrence Livermore National Laboratory
Dan Burns - Science Teacher - Los Gatos High School

Student Anticipation Guide and Worksheet
The **ME**rcury Surface, Space **EN**vironment**, GE**ochemistry **and R**anging (**MESSENGER**) space probe is a robotic NASA spacecraft in orbit around the planet Mercury. The Messenger spacecraft is the first to orbit planet Mercury. Its discoveries are revolutionizing our understanding of Mercury and the formation of the solar system. Test your knowledge by circling True or False next to each statement below. Revisit your answers at the end of the presentation to see how well you did.

T F It took Messenger 5 years to reach Mercury.

T F The Sun appears 11 times brighter from Mercury's surface.

T F Evidence for ice on Mercury has been found.

T F Gamma rays come from the nucleus of an atom.

T F The Gamma Ray Spectrometer is coated with pure platinum.

T F The Gamma Ray Spectrometer has no practical uses on Earth.

Listen carefully to the presentation to answer the questions during the talk. You may need these answers to get credit from your teacher.

1. Mercury was named for the Roman god who served as a messenger. What does the spacecraft Messenger's name mean?

2. What type of rocket launched Messenger to Mercury?

3. What does GRS stand for?

4. Mercury has the greatest temperature range between night and day of any planet. What is the difference between the hottest and coldest temperature on Mercury?

5. List the 5 major science objectives of the Messenger mission below:

1. _____ 2. _____
3. _____ 4. _____
5. _____

6. How did the spacecraft designers protect the spacecraft from the direct illumination from the sun?

7. How did engineers overcome the challenge of the excessive fuel required to reach and orbit Mercury?

8. How much shielding was needed to block most of the gamma rays in the demonstration?

9. Which of the 4 spectra choices was not seen in the demonstration?

10. Which of these processes produces gamma rays on Mercury (circle those that apply)? Collisions with neutrons Neutron Capture Natural Radioactivity

11. Describe how a Stirling-Cycle cryocooler works.

12. What can the GRS be used for on Earth?

California Science Standards

Physics 1e: Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.

Physics 4e: Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).

Chemistry 11d: Students know the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay.

Chemistry 11e: Students know alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations.